TEACHING EFFECTIVENESS OF HIGH-PERFORMANCE COMPUTING USING AN ONLINE COURSE

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ABSTRACT

It is important to put stress on a current and innovative teaching and thus leading subjects for students nowadays. This is valid for universities primary. An example of conducting the subject „HPC and Grid Architecture" in the environment MOODLE is introduced in the article. After making research among students who had passed this subject and after making comparison with other possibilities that are available online, the output was made. Issues discussed are focused on its interesting thing, the way of lecture and availability of subject´s content.

KEYWORDS: HPC, MOODLE, MOOC, e-learning.

Introduction

Nowadays is very popular using cloud computing and very important role of high performance computing (HPC). (1) Both technologies are using virtual machines. The aim of our work is bring up result of finished online course. Course was taken by 20 students during their second year study on bachelor degree at University of Ss. Cyril and Methodius in Trnava. Practice with HPC cluster was taken at Matej Bel University in Banská Bystrica via ssh connection. As the teaching at universities through mailing-cards in 18th century started and continued by development of technologies such as radio and television, is teaching at a distance still more popular for its accessibility via Internet. (3) The result of new modern technologies is the change of cooperation between teacher and student.

The field and degree of studies are factors influencing the decision how to place them correctly. Some departments are suitable more, some less. For private studying are preferred courses of natural sciences.

The question of assessment is connected with the popularity and number of students signed in MOOC as well. To assess a few dozens of students through traditional way of course teaching is not a problem. But how to reach the assessment that will be quick, effective and the most equivalent to the reality when there are thousands of students? Cardinal and ordinal inlets are used for this kind of assessment. Both of these inlets have their own substantiation but they are different in their effectiveness which depends on reviewed issue. In as much as it is impossible to assess quantum of students and their works by professor or his assistant, it is common to use a so-called peer assignment. Within the peer assignment are students evaluating their works between each other. Every required evaluation is the result of average assessment brought by more users. Regarding of specification and correctness of the evaluation by users can be additionally used and applied factorization method with the application of algorithm applies provided data as input evaluation but takes into consideration also very different assessments. (4) With features typical for MOOC are connected also requirements for computer sources. Since we assume relatively huge interest of their usage, it is important to provide fast and stable connectivity for video streams, continuous accessibility and sufficient storage place. Executive computer servers are the solution, but better scalability and financial effectiveness will be reached by using cloud computing, especially in the case of abrupt on-demand configuration. Public and private cloud, on the other hand, are suitable for technique of on-demand automatic scale.

Taking into consideration all our requirements and above mentioned information about solving some of problems, we decided for Modular Object-Oriented Dynamic Learning Environment (MOODLE) which is used academically.

MOODLE´s environment is open source license of Learning Management System (LMS). MOODLE offers wide possibilities of pursuing educational courses. Apart from basic ideology about providing students study materials and administer the content, MOODLE offers also the possibility of important feedback, interactive form of active engaging into courses within quizzes and testing the knowledge. Equally important features, which are provided by this educational system, are a database of attainments, chat with other course participants, plugin installation and change of appearance for individual lectures. (5) MOODLE community has wide user base and is offering high-class support, documents and discussion forums.

Other systems providing LMS that are useful for leading online training course are for example Doceba, Ilias and Atutor.
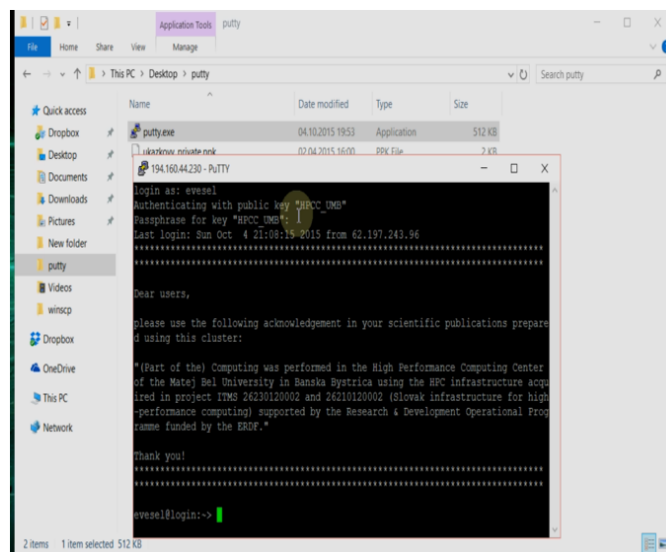

Figure 1: Graphic elements in MOODLE course.

Materials and Methods:

The course „HPC and Grid Architecture" is presented by form of thematic course, i.e. to the user is given the scheduling of individual courses. Leading the course in such a way brings better limpidity in comparison to date guide, variability and control above given interpreted information and lecture. In total, there are 12 theoretical and practical circuits of themes that lead to reaching assigned aims and pass the course. These circuits are:

- History and present of computers
- Installing four Ubuntu Servers in Virtualbox
- Network configuration
- Computer architectures
- Torque installing
- High performance computing (part 1)
- Maui installing
- OpenMPI installing
- High performance computing (part 2)
- Cloud computing
- Grid computing
- Work on HPC cluster

The conception of themes is always based on an introductory part when user is familiarized with the aim of the given lecture and in case of prerequisites needed which are recommended for better understanding of lecture. To make the lecture more attractive, the content is supplemented by visual materials such as relevant photographs and graphics. In addition to practical tasks and techniques should be

added video tutorial with recorded audio (Fig 1).

The entire introduction of the course consists of necessary basic information which lead participant to the theory of computer clusters, their history and contemporary usage up to the current status of department's involvement in the Slovakia-wide project. (6) The upcoming theme for the introductory information on the subject matter is hardware description.

The interpretation of the theoretical part is based on programming methods, Flynn´s taxonomy and memory architecture used for applying in computer clusters.

A theme is dedicated to substantial information about available software options and compilers. The core of interpretation is composed of facts about working environment which is operating system, specialized programs for scientific departments and support of compilers for individual programming languages.

Methodology of work in the computer cluster is the summary of facts and for course participants it is the first practical activity of working at HPC and GPGPU based job scheduling, which is also important. (7) Successful launching of the task requires observation of necessary steps. Among these steps belong securing authentication through generating new own private key for login into the cluster, creating user account at administrator, preparation and transfer of startup script and program for cluster, successful login into the cluster and compilation and launching startup script at the end. Single operations are written step-by-step and inevitable actions are realized on free software. In situations where advance workings take place is progress depicted through operating systems Linux and Microsoft Windows.

The aim of the course is to learn participants and at the same time offer them the space for making launching of the action on HPC. This activity includes Launching script and Examples. In the first case are described features and the meaning of syntax for task scheduler. Demonstrations include individual cases which can occur in the practice. Gained knowledge and practice will be used in provided examples.

The output of the course is paper test according to which can be objectively taken into account the level of gained information for successful using of HPC and launching of tasks.

Results:

After completing the course, 20 students filled in anonymous questionnaire which aim was to bring the feedback for the teacher. Questions stepped out from previous research of developing pedagogical competence (8). The average mark is the range of possible merits 1 – the best up to 5 – the worst. The result is depicted in the table 1.

Table 1: Question from questionnaire (left) and average evaluation after course (right).

1. COURSE CONTENT	Average rank
The subject matter was actual with hierarchy ordering:	1.05
The subject matter was divided into meaningful units of learning:	1.15
The subject matter will be useful for me in practical life:	1.25
The course helped me to clarify the topic:	1.1
2. TEACHERS EVALUATION	**Average rank**
Teachers' interpretations were understandable and clear:	1.25
Teachers created sufficient space for questions and discussion:	1.15
Teachers adequately used teaching aids and equipment:	1.25
Teachers connected theory with examples from practice:	1.2
Teachers made space for practicing new knowledge:	1.4
3. FEELS OF PROGRESS	**Average rank**
I gained important new findings:	1.2
I have developed new skills in this area:	1.3
I understand how to solve problems:	1.55
I believe that my power will be improved in the workplace:	1.5
I will use in practice what I have learned on the course:	1.6

The positive contribution for better evaluation from feedback can be brought by MOOC. Few works is concerned with the issues of MOOC. Variability of offered courses and the chance to attract attention of people is high, some of them being recorded on the particular issues, some of them on wide area of usage. Many people are daily interested in the possibility of this kind of courses and despite this fact, there is huge number of participants who do not finish the course they had applied to. According to the online questionnaire and its feedback by MOOC users, the reason of not finishing the course is time. More than 51 % of users tagged this reason within which are covered bad organization from provider, intersection with daily duties and as the last one, the general severity important for passing the course. On the other hand, time is the important part of learning and it demands single process. With huge distance (only 17 %, resp. 16 %) were on the second and third place put stepping out of the rhythm (illness or business trip). Better specification of tasks is one of the solutions for reaching required aims. Also the support from the side of course providers such as better awareness about time seriousness for particular processes required for the deadline. In the end, is is basic user´s self-reflection who must take into the awareness all conditions required by MOOC. (9)

On the base of research, 310 students from Global International School, Saudi Arabia can be seen that up to 95 % of students agree with the learning that is out of traditional class. (10)

REFERENCES:

1. Moodlenews. (2012): 300 Years of Distance Learning: From Correspondence Courses to Moodle, available at http://www.moodlenews.com/2012/300-years-of-distance-learning-from-correspondence-courses-to-moodle/, accessed 16 June 2016.

2. Moodlenews. (2012): 300 Years of Distance Learning: From Correspondence Courses to Moodle, available at http://www.moodlenews.com/2012/300-years-of-distance-learning-from-correspondence-courses-to-moodle/, accessed 16 June 2016.

3. Marques, J. (2013): A Short History of MOOCs and Distance Learning, available at http://moocnewsandreviews.com/a-short-history-of-moocs-and-distance-learning/, accessed 16 June 2016.

4. Luaces, O., Diez, J., Alonso-Betanzos A., Troncoso A. and Bahamonde, A. (2015). A factorization approach to evaluate open-response assignments in MOOCs using preference learning on peer assessments. Knowledge-Based Systems, 85, p. 322–328.

5. MOODLE. (unknown): Features, available at https://docs.moodle.org/29/en/Features, accessed 16 June 2016.

6. SIVVP. (2016): Slovac infrastructure for high performance computation, available at http://www.sivvp.sk/home/, accessed 16 June 2016.

7. Škrinárová, J. and Povinský, M. (2015): FGPGPU based job scheduling simulator for hybrid high-performance computing systems. Scientific Conference on Informatics, 2015 IEEE 13th International, IEEE, p. 269 - 274

8. Škrinárová, J., Horváthová, D. and Gubalová, J. (2013): Feedback influence to development of pedagogical competencies of doctoral students. GRANT journal, 2, p. 46-51

9. Nawrot, I. and Doucet, A. (2014): Building engagement for MOOC students: introducing support for time management on online learning platforms. Proceedings of the 23rd International Conference on World Wide Web, ACM, p. 1077-1082

10. Brahimi, T. and Sarirete, A. (2015): Learning outside the classroom through MOOCs. Computers in Human Behavior, 51, p. 604–609